# RESPONSE TO COMMENTS
# CITY OF COEUR D'ALENE NPDES PERMIT
# (NPDES No. ID-002285-3)

U S Environmental Protection Agency
July 22, 1999

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The Environmental Protection Agency, Region 10 (EPA) is reissuing the National Pollutant Discharge Elimination System (NPDES) permit for the City of Coeur d'Alene (NPDES permit number ID-002285-3). On April 19, 1999, EPA shared pre-decisional draft copies of the permit with the Spokane River Technical Advisory Committee (TAC), a group that includes the State of Idaho Division of Environmental Quality (IDEQ), the Coeur d'Alene Tribe, municipalities, and industry. Following review by the TAC, EPA prepared a draft permit for public comment. The comment period on the draft permit began on June 18, 1999, and ended on July 23, 1999. A public hearing was held by EPA in Coeur d'Alene on July 19, 1999.

During the comment period, EPA received comments from IDEQ, the City of Coeur d'Alene, and its contractor, HDR Engineering. In addition, changes were made to the permit based on conditions in the State's 401 certification of the proposed final permit. This document provides a summary of the substantive comments and the responses to comments. Appendix A contains a summary of changes to the permit.

## A. Metals

**1.** **Comment:** HDR commented that EPA should disclose their calculations for metals and chlorine and allow the City adequate time to review and comment on them. They later clarified that their concern was focused on the development of the limitations for silver. Specifically, they questioned the use of an "end-of-pipe analysis" for the silver limit rather than a "wasteload allocation analysis" using a mixing zone.

They also questioned why the allowable silver concentration decreased by roughly 20 percent since the predecisional draft of the permit.

**Response:** Appendix B contains the calculations for the silver limitations in the final permit. In the pre-decisional draft permit EPA inadvertently used the effluent hardness and no mixing zone to develop the permit limits for silver. Because a mixing zone was not used, seasonal flows were not relevant and there were no seasonal limits. Upon re-evaluation, EPA determined that using edge-of-mixing zone hardness and the dilution available in the mixing zone results in slightly less stringent limits. In addition, the use of a mixing zone makes seasonal flows relevant. Therefore, the final permit includes seasonal limits for silver based on compliance with state water quality criteria at the edge of the mixing zone. See the response to comment number 2 for additional changes to the silver limits.

The decrease in the monthly average permit limit for silver was caused by the change in the coefficient of variation (CV) that was used for permit limit

development. In the pre-decisional draft, EPA used only three data points to develop a limit for silver. When there are fewer than 10 data points, EPA's *Technical Support Document for Water Quality-based Toxics Control* (TSD) recommends using a default value of 0.6 for the CV. In the draft permit, EPA used an additional 12 data points generated by the City as part of its pretreatment requirements. Because there were a total of 15 data points, EPA was able to calculate a CV of 0.8 for silver. The increased CV means that there is increased variability in the effluent quality. Therefore, the monthly average value must be lower so that there is less likelihood of violating the long-term average.

**2**. **Comment:** The City requested that the limitations for copper, lead, silver, and zinc be recalculated for flows less than 4.2 million gallons per day (mgd) and greater than 4.2 mgd. The City is currently discharging at a rate of 3.0 mgd. The metals limitations in the draft permit were derived using the design flow of 6.0 mgd. The City does not believe that it should not be required to meet limitations at this time that are based on flows that are twice the current discharge rate. Calculations using a flow of less than 4.2 mgd will not cause a undue burden on the citizens of Coeur d'Alene brought on by unnecessary wastewater plant facility upgrades.

**Response:** EPA agrees that the use of tiered flows is appropriate for copper and silver, which allow for dilution in a mixing zone. In the case of lead and zinc, however, effluent flow is irrelevant because the criteria must be met at the point of discharge.

Use of a lower effluent flow increases the dilution available at the edge of the mixing zone. This allows for increased dilution of the metals, but it also increases the dilution of the high hardness effluent with lower hardness ambient water. Decreased hardness results in more stringent criteria. For copper, the decreased hardness is offset by the increased dilution, so that the limits at the low flow are higher than the high flow tier. However, for silver during the summer season, the decrease in hardness means that the effluent limit is actually more stringent at 4.2 mgd than at 6.0 mgd.

As in the draft permit, there is no reasonable potential for the City's discharge to contribute to an exceedence of the copper criteria in the winter. Therefore, the copper limits in the final permit apply during summer (July 1 through September 30) only.

Table 1 summarizes the copper and silver limits in the final permit.

| Table 1: Copper and Silver Limits for the City of Coeur d'Alene | | | | | |
|---|---|---|---|---|---|
| **Season** | **Effluent Flow (mgd)** | **Copper Limits, Fg/l (lb/day)** | | **Silver Limits, Fg/l (lb/day)** | |
| | | **Daily Max** | **Monthly Avg** | **Daily Max** | **Monthly Avg** |
| Summer | 4.2 | 37 (1.3) | 20 (0.70) | 2.7 (0.094) | 1.2 (0.042) |
| | 6.0 | 33 (1.7) | 18 (0.90) | 3.0 (0.15) | 1.3 (0.065) |
| Winter | 4.2 | --- | --- | 3.9 (0.14) | 1.7 (0.060) |
| | 6.0 | --- | --- | 2.8 (0.14) | 1.2 (0.060) |

**3.** **Comment:** A number of studies have indicated that biologically-treated municipal wastewaters are not toxic with respect to copper. A good summary of this issue is presented in the June 1997 edition of Water Environment and Technology. It is highly probable that a Water Effect Ratio (WER) test for the City's discharge to the Spokane River would demonstrate that copper toxicity is not a problem; however, this is a costly undertaking. To avoid this unneeded expense, the City requests EPA and IDEQ to 1) review national data on copper toxicity and WER tests, 2) waive the need for the City to conduct a site-specific WER test, and 3) determine that a limit on copper is not needed.

**Response:** EPA does not agree that it is appropriate at this time to rely on tests conducted with other facilities' effluents to derive a WER for the City of Coeur d'Alene's treatment plant. Although it is true that copper in municipal effluent tends to be less toxic, low pH (6.5 or less), such as that found in the City's discharge, may actually increase copper's toxicity. Therefore, without more site-specific information, EPA is unable to conclude that a copper limit is unnecessary.

**4.** **Comment:** HDR asked for clarification regarding the derivation of the effluent limits for lead. They also questioned why EPA reduced the allowable concentrations and mass limits for lead by 20 percent from the predecisional draft to the draft permit.

**Response:** See Appendix C for a detailed discussion of the derivation of the lead criterion. As with silver, the additional data from the City's pretreatment program resulted in an increased CV for lead (from 0.4 to 0.8). This change resulted in less stringent maximum daily limitations and more stringent monthly average limitations.

**5.** **Comment:** HDR asked what change occurred between the predecisional draft and draft permit that caused EPA to add concentration and mass limits for zinc.

**Response:** In the predecisional draft permit, EPA used only 13 data points collected by the City during 1997. In preparing the draft permit, EPA used a larger data set, including sampling done as part of the City's pretreatment requirements. This larger data set included concentrations that were high enough to indicate that there was reasonable potential for the discharge to contribute to exceedences of the criteria. Where there is reasonable potential, EPA must include a limit in the permit.

## B. Other Pollutants

**6. Comment:** The ambient pH used for calculating the ammonia criteria appears quite high in comparison to the ambient pH values for the Spokane River presented in Table C-11 in the Fact Sheet of 6.86 in the summer and 6.6 in the winter. We are concerned about the accuracy of the database used in determining historical pH values in the Spokane River.

**Response:** The 5$^{th}$ and 95$^{th}$ percentiles for ambient pH were calculated based on data collected by the State of Washington Department of Ecology at Stateline Bridge between 1992 and 1997 and at the Post Falls gage between 1973 and 1990, and data collected by the City of Coeur d'Alene upstream and downstream of the City's outfall between 1992 and 1999. The values presented in Table C-11 are 5$^{th}$ percentile values, while the value used for calculating the ammonia criteria is a 95$^{th}$ percentile value.

Based on further review of the data and discussions with IDEQ, EPA believes that the Ecology data are not representative of conditions at the City's outfall. As the river flows from the outlet of Coeur d'Alene Lake to the State line, algal productivity increases, causing increases in ambient pH. Therefore, EPA deleted the Ecology data and added five data points provided by IDEQ. The results of this analysis and the changes in the limits for ammonia are summarized in Table 2. Because the water quality criteria have increased, there is no longer reasonable potential for the discharge to contribute to an exceedence of the water quality standard in the winter. Therefore, the winter ammonia limits have been removed from the final permit.

**Table 2: Ammonia Criteria and Limits**

| Season | Chronic Criterion, mg/l | Ambient pH (95$^{th}$ %ile) | Effluent Flow, mgd | Effluent Limitations, mg/l (lb/day) | |
|---|---|---|---|---|---|
| | | | | Daily Max | Monthly Avg |
| Summer | 1.17 | 7.5 | 4.2 | 29 (1,000) | 10 (350) |
| | | | 6.0 | 21 (1,100) | 7.4 (370) |
| Winter | 2.15 | 7.7 | 4.2 | --- | --- |
| | | | 6.0 | --- | --- |

**7.** **Comment:** The proposed effluent limit for phosphorus fails to recognize the underlying premise of the Long Lake management plan, which is to keep the overall phosphorus contribution to the river below a threshold limit. With the proposed language, the City could be penalized for slight exceedences of the effluent limit even if the total phosphorus load from all contributors was well below the prescribed threshold. This seems unfair and unnecessary. EPA should consider permit language that incorporates a "bubble concept" with respect to phosphorus control.

**Response:** Section IV.C.1.e. of the Spokane River Phosphorus Management Plan specifically states that the City of Coeur d'Alene's NPDES permit will require 85 percent removal of phosphorus. The "bubble concept" is included in the Plan, but it is limited to industrial dischargers. EPA does not believe that it is appropriate to change the scope of the Management Plan.

**8.** **Comment:** Table 1 contains an arithmetic error in the wintertime mass limits for total residual chlorine.

**Response:** The error has been corrected. The loadings for chlorine during winter are now monthly average and daily maximum values of 7.5 and 30 lb/day, respectively.

**C. Mixing Zones**

**9.** **Comment:** The summer 1Q10 value is too low and does not reflect the impact of the revised Post Falls operating strategy adopted in 1982. A preliminary review of the Spokane River flow data during the 1968 to 1998 period designated by IDEQ indicates that derivation of the 1Q10 flow is strongly influenced by several low flow events that occurred during the 1970s. Initial attempts to correlate these low flow events with precipitation or snow pack records found that several of the low flow events occurred during relatively normal weather years. This suggests that some low flow events may be more influenced by pre-1982 operating strategies for the Post Falls dam than by drought conditions.

**Response:** Mixing zones are designated by the State, not EPA. In its 401 certification, the State established 163 cubic feet per second (cfs) as the appropriate one-day, 10-year low flow (1Q10) for calculating the acute mixing zone. Based on the 401 certification, EPA is using that flow to calculate concentrations at the edge of the acute mixing zone.

EPA agrees with the State that 163 cfs is an appropriate value for the 1Q10 flow. Without specific information for each low flow event, it is impossible to determine which ones were caused by the pre-1982 operating strategy for the Post Falls

dam. In addition, there is nothing in the current operating requirements for the Post Falls dam that would preclude them from having very low flows if the inflow to Coeur d'Alene Lake is less than 300 cfs. Therefore, the entire record from 1968 to 1998 should be used in calculating the 1Q10.

**10.** **Comment:** The City requested that a 25 percent mixing zone be allowed for calculating the Primary Contact Recreation and the Secondary Contact Recreation Limits for fecal coliform. The Primary and Secondary Contact Recreation limits are limitations based on instream water quality limits not wastewater plant effluent limits.

**Response:** Mixing zones are authorized by the State, not EPA. Idaho does not typically allow mixing zones for compliance with the recreational standards for fecal coliform bacteria. A review of the data submitted by Coeur d'Alene shows that, with few exceptions, the City complies with the limits in the final permit without a mixing zone. EPA does not believe it is appropriate to provide a mixing zone where it is not necessary.

**D. Pretreatment/Biosolids**

**11.** **Comment:** The City requested that the pretreatment requirements "just make reference to '503' requirements".

**Response:** There are some differences between the sampling required to fulfill the pretreatment requirements in the permit and the "503" (sludge) requirements. To the extent that pretreatment sampling meets the sludge sampling requirements in the permit, those results can be used to fulfill the sludge requirements.

**12.** **Comment:** The City requested that the pretreatment monitoring frequency be reduced to once per year.

**Response:** For a facility the size of the City of Coeur d'Alene, EPA believes that pretreatment monitoring should be conducted twice a year. Sampling during wet and dry seasons gives EPA better information regarding effluent variability, inflow and infiltration.

**13.** **Comment:** The City suggested that the language in part II.G.4 of the permit be changed from "Sludge samples shall be taken as the sludge leaves the treatment processes and before mixing with sludge of different age in drying beds or in storage" to "Sludge samples shall be taken as the sludge leaves the dewatering device or digesters."

**Response:** The change has been made.

**14.** **Comment:** The City expressed concern that the provision prohibiting them from receiving sludge mixed with sewage (Section III.G of the permit) would prevent them from accepting septage or jointly composting with other municipalities as was considered and recommended in the regional facilities plan.

**Response:** The purpose of this provision is to prevent the City from accepting sludge from another facility and routing it through the City's sewage treatment plant. This provision does not prevent other facilities from sending their sludge to the City's composting facility. Septage is not considered by the Agency to be sludge mixed with sewage, so this prohibition has no effect on the City's ability to accept septage.

**15.** **Comment:** The City requested that the word "toxic" be deleted from part III.C. of the draft permit because sludge is not toxic.

**Response:** Part III.C. of the permit refers to those pollutants defined at 40 CFR 401.15 as "toxic pollutants". Under these regulations, many pollutants found in sludge, including metals, are considered "toxic pollutants".

**E. Monitoring**

**16.** **Comment:** The City requested that the sampling frequency for ammonia be reduced to weekly between October 1 and June 30. The city believes that a weekly frequency is sufficient to monitor ammonia concentrations during the non-critical period.

**Response:** EPA agrees that it is appropriate to reduce the monitoring frequency for ammonia during the winter. The final permit has been changed accordingly.

**17.** **Comment:** The City requested that the sampling frequency for phosphorus be reduced from 3/week to weekly during the non-critical time period.

**Response:** The draft permit only requires monitoring for phosphorus during the critical period. No monitoring is required at other times during the year.

**18.** **Comment:** The City requested that whole effluent toxicity testing be reduced to annually if testing indicates no toxicity. Toxicity testing is expensive and the City has demonstrated through laboratory records and the establishment of an active pretreatment program that toxicity is not a parameter that should require undue concern. They would further request that the testing be the 24-hour "screening" level test rather than a complete "definitive level" test.

**Response:** EPA does not agree that annual testing is adequate to characterize the whole effluent toxicity of the City's effluent. When evaluating whether limits

are needed in a permit, EPA must look at whether there is "reasonable potential" to cause or contribute to an exceedence of the criteria. This requires multiplying the maximum effluent concentration by a "reasonable potential multiplier" based on the number of data points and the coefficient of variation (CV) of the data. Where there are fewer than 10 data points, the TSD recommends using a default CV of 0.6. EPA believes that it is preferable to use a site-specific CV. To allow the City to spread the cost out, the permit requires that the 10 data points be collected during the five-year term of the permit, instead of requiring more frequent testing over a shorter time period. In addition, semi-annual testing will give EPA valuable information about differences between wet and dry season effluent quality. The decision to require semi-annual WET testing is supported by EPA's national variability WET guidance.

EPA does not agree that 24-hour screening tests are adequate to characterize the City's effluent. Chronic testing is necessary to determine whether the effluent could have chronic effects on biota.

## F. Miscellaneous

**19.** **Comment:** HDR commented that several of the new limits, if included in the final permit language, will result in the need for major capital improvements to the City's treatment plant. Adequate time will be needed to plan, design, finance, construct and start-up these facilities. It is essential that the permit contain a reasonable compliance schedule to implement the needed improvements.

**Response:** Idaho's water quality standards give the State, not EPA, the authority to establish compliance schedules. As part of its certification under section 401 of the Clean Water Act (CWA), IDEQ specifies any compliance schedules that may be included in the permit. In the certification for this permit, the State authorized compliance schedules for ammonia, metals, and fecal coliform bacteria. See response to issue number 3 in section G, below for further discussion.

**20.** **Comment:** The City requested that a "re-opener" clause be placed in the permit to allow for changes in water quality standards. They also requested that if the city performs WER tests for copper or other metals that the EPA modify the permit accordingly.

**Response:** Section VI.M of the permit is the reopener. This section of the permit outlines the conditions under which the permit may be modified, including changes to the State water quality standards or development of a WER.

**21**. **Comment:** The City commented that the provisions requiring the development and implementation of a public education program and water conservation (V.E.3.c. and d) are outside the limits of local government.

**Response:** EPA does not agree that these requirements exceed the authorities of local government. In fact, municipalities are in the best position to know how to encourage their citizens to responsibly dispose of hazardous wastes and conserve water. Many municipalities have developed public education and water conservation programs. Phil Bandy, of IDEQ, can provide assistance in developing these programs. He can be reached at (208) 373-0439.

## G. Issues Raised in State 401 Certification

**1.** **Issue:** IDEQ requires that the permit contain monitoring for E.coli bacteria, in anticipation of new water quality standards. They indicated that monitoring be required during the 4$^{th}$ year of the permit term at the same frequency as fecal coliform monitoring (4 times weekly).

**Response:** EPA has included this requirement in the final permit.

**2.** **Issue:** IDEQ requested that EPA explain the rationale behind requiring static renewal whole effluent toxicity testing, instead of static testing.

**Response:** The requirement to use static renewal testing was included in the permit based on the recommendations in EPA's *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms*, Third Edition (EPA-600-4-91-002). Static renewal testing is more sensitive than static non-renewal testing because renewing the test solution reduces the chance of volatilization, degradation, or adsorption of the toxicants. In addition, static renewal testing reduces the possibility of dissolved oxygen depletion, which could stress the test organisms.

**3.** **Issue:** IDEQ authorized 2-year compliance schedules for ammonia, metals, and fecal coliform bacteria. As part of these schedules, IDEQ required the submittal of monitoring results to determine compliance with the limits and to establish schedules for any necessary modifications to the treatment plant.

**Response:** EPA incorporated these requirements in the final permit.

# APPENDIX A

## Summary of Permit Changes

This appendix provides a summary of changes made from the draft to the final NPDES permit for the City of Coeur d'Alene. The changes are listed by section.

I.A.1: ammonia limitations increased: winter ammonia limits deleted: ammonia monitoring during winter decreased: 2-year compliance schedule added.

I.A.1: winter total residual chlorine loading decreased.

I.A.1: 2-year compliance schedule for metals added.

I.A.1: copper limitations for effluent flows of 4.2 mgd or less added.

I.A.1: seasonal silver limitations for effluent flows of 4.2 mgd or less added: summer silver limitations added: winter silver limits increased.

I.A.1: 2-year compliance schedule for fecal coliform bacteria added.

I.A.1: monitoring for E. coli bacteria added.

I.A.1: "Washington Water Power" changed to "Avista Corp." in Footnote 8 of Table 1.

II.E: Added provisions prohibiting the facility from accepting wastes containing:

Heat in amounts which inhibit biological activity in the treatment works resulting in interference;

Petroleum oil, nonbiodegradable cutting oil, or products of mineral oil origin in amounts that will cause interference or pass through;

Wastes which result in the presences of toxic gases, vapors, or fumes within the treatment works in quantity that may cause acute worker health and safety problems; and

Any trucked or hauled pollutants, except at discharge points designated by the treatment works.

II.G.4: The language has been simplified to require sample collection as the sludge leaves the dewatering device or digesters.

V.K: Added the provisions of 40 CFR 122.41(l)(2) (notification for anticipated noncompliance).

# APPENDIX B

## Effluent Limit Calculations for Silver

Step 1: Determine the appropriate criteria

1A. Determine the uses

The Spokane River is protected by the State of Idaho for the following uses: domestic and agricultural water supply, cold water biota, salmonid spawning, and primary and secondary recreation

1B. Determine the most stringent criterion to protect the uses

The most stringent silver criterion associated with these uses is the aquatic life criterion for cold water biota and protection of salmonid spawning. The criterion is an acute value only (also known as a "criteria maximum concentration" or CMC), calculated based on hardness. The equation for the CMC is:

$$CMC = 0.85 * \exp(1.72 * \ln[\text{hardness}] - 6.52)$$

This criterion is based on the dissolved form of the metal. A factor of 0.85 has been used in the above equation to convert from the total recoverable form to the dissolved form.

The hardness used in this equation is the hardness at the edge of the acute mixing zone. It was calculated as a mass balance of the effluent and upstream (ambient) hardness, using the following equation:

$$H_d = \frac{(H_e * Q_e) + (H_u * (Q_u * \%MZ))}{Q_e + (Q_u * \%MZ)}$$

where,

$H_d$ = receiving water hardness at the edge of the mixing zone
$H_e$ = 5th percentile effluent hardness (132 mg/l $CaCO_3$)
$Q_e$ = maximum effluent flow (6.5 and 9.3 cfs)
$H_u$ = 5th percentile upstream hardness (12.65 mg/l $CaCO_3$)
$Q_u$ = upstream flow (163 cfs for summer, 728 cfs for winter)
%MZ = % of upstream flow allowed for mixing zone (25%)

The hardness at the edge of the mixing zone was evaluated for effluent flows of 4.2 mgd (6.5 cfs) and 6.0 mgd (9.3 cfs) as well as summer and winter stream flows. When the calculated hardness was less than 20 mg/l $CaCO_3$, 20 mg/l was used. This approach is consistent with that used by the State of Washington for the Spokane

River. Table B-1 presents the hardness values and criteria for each of the effluent flows for each season.

**Table B-1: Coeur d'Alene Dissolved Silver Criteria**

| Season | Effluent Flow, mgd | Hardness, mg/l $CaCO_3$ | CMC, Fg/l |
|---|---|---|---|
| Summer | 4.2 | 29 | 0.41 |
| | 6.0 | 35 | 0.57 |
| Winter | 4.2 | 20 | 0.22 |
| | 6.0 | 20 | 0.22 |

Step 2: Determine whether there is "reasonable potential" to exceed the criteria

2A. Determine the "reasonable potential" multiplier

The "reasonable potential" multiplier is based on the coefficient of variation (CV) of the data and the number of data points. For silver, there are 15 data points, which EPA used to calculate a CV of 0.8. Using the equations in section 3.3.2. of EPA's *Technical Support Document for Water Quality-based Toxics Control* (TSD), the "reasonable potential" multiplier (RPM) is calculated as follows:

$$p_n = (1 - \text{confidence level})^{1/n}$$

where,

$p_n$ = the percentile represented by the highest concentration
$n$ = the number of data points

$$p_n = (1-0.99)^{1/15}$$
$$p_n = 0.74$$

This means that the largest value in the data set is greater than the $74^{th}$ percentile.

Next, the ratio of the $99^{th}$ percentile to the $74^{th}$ percentile is calculated, based on the equation:

$$C_p = \exp(zF - 0.5F^2)$$

where,

$F^2 = \ln(CV^2 + 1)$
$= 0.49$
$CV = 0.8$

z = normal distribution value
= 2.326 for the 99th percentile
= 0.6433 for the 74th percentile

$C_{99}$ = exp(2.326*0.70 - 0.5*0.49)
= 3.99

$C_{98}$ = exp(0.6433*0.70 - 0.5*0.49)
= 1.17

RPM= $C_{99}/C_{98}$
= 4.00/1.23

**RPM= 3.3**

2B. Calculate the concentration of the pollutant at the edge of the mixing zone

There is reasonable potential to exceed criteria if the maximum projected concentration of the pollutant at the edge of the mixing zone exceeds the criterion. The maximum projected concentration is calculated from the following equation:

$$C_d = \frac{(C_e * Q_e) + (C_u * (Q_u * \%MZ))}{Q_e + (Q_u * \%MZ)}$$

where,

$C_d$ = receiving water concentration at the edge of the acute mixing zone
$C_e$ = maximum projected effluent concentration
= maximum reported effluent concentration * reasonable potential multiplier (6.39 Fg/l *3.3 = 21 Fg/l)
$Q_e$ = maximum effluent flow (6.5 cfs and 9.3 cfs)
$C_u$ = upstream concentration of pollutant (0.107 Fg/l)
$Q_u$ = upstream flow (163 cfs for summer, 728 cfs for winter)
%MZ = % of upstream flow allowed for mixing zone (25%)

In order to compare the edge-of-mixing zone total recoverable concentration to the dissolved criterion, it is necessary to multiply by a “translator”. Because there is no site-specific “translator” for silver in the City’s discharge, 0.85 (the conversion factor in step 1B.) was used as a default multiplier.

Table B-2 shows the edge-of-mixing-zone silver concentrations for each flow for each season. Because all the concentrations exceed the criteria in Table B-1, limits must be established in the permit for each flow tier and each season.

| Table B-2: Coeur d'Alene Silver Concentrations | | |
|---|---|---|
| Season | Effluent Flow, mgd | Dissolved Silver Concentration, Fg/l |
| Summer | 4.2 | 2.6 |
| | 6.0 | 3.4 |
| Winter | 4.2 | 0.72 |
| | 6.0 | 0.97 |

Step 3: Calculate the wasteload allocations

A wasteload allocation (WLA) is calculated using the same mass balance equation used to calculate the concentration of the pollutant at the edge of the mixing zone. However, $C_d$ becomes the CMC and $C_e$ is replaced by the acute WLA. The equation is rearranged to solve for the WLA, becoming:

$$WLA = \frac{CMC*(Q_u * \%MZ + Q_e) - Q_u*C_u*\%MZ}{Q_e}$$

The WLA is then converted to a long-term average concentration, using the following equation from the TSD.

$$LTA = WLA * \exp[0.5F^2 - zF]$$

where,

$F^2$ = $\ln(CV^2 + 1)$
= 0.49
z = 2.326 for 99$^{th}$ percentile probability basis.

Table B-3 shows the WLAs and LTAs for the City. Note that the values in this table are for total recoverable metals. Because it is uncertain how much of the metal in a permittee's discharge converts into the dissolved form in the receiving water, EPA's regulations at 40 CFR 122.45(c) require that effluent limits be expressed as total recoverable metals. As in steps 1B and 2B, 0.85 is used as a default "translator".

| Table B-3: Coeur d'Alene Total Recoverable Silver WLAs | | | |
|---|---|---|---|
| Season | Effluent Flow, mgd | WLA, Fg/l | LTA, Fg/l |
| Summer | 4.2 | 2.72 | 0.68 |
| | 6.0 | 3.04 | 0.76 |
| Winter | 4.2 | 3.87 | 0.96 |
| | 6.0 | 2.78 | 0.69 |

Step 4: Derive the maximum daily (MDL) and average monthly (AML) permit limits.

Using the TSD equations, the MDL and AML permit limits are calculated as follows:

$$MDL = LTA * \exp[zF-0.5F^2]$$

where:

$F^2$ = $\ln(CV^2 + 1)$
= 0.49
z = 2.326 for 99th percentile probability basis

$$AML= LTA_c * \exp[zF- 0.5F^2]$$

where:

$F^2$ = $\ln(CV^2/n + 1)$
= 0.148
n = number of sampling events required per month (4)[1]
z = 1.645 for 95th percentile probability basis

**Table B-4: Coeur d'Alene Total Recoverable Silver Limitations**

| Season | Effluent Flow, mgd | Effluent Limitations, Fg/l | |
|---|---|---|---|
| | | Maximum Daily | Average Monthly |
| Summer | 4.2 | 2.7 | 1.2 |
| | 6.0 | 3.0 | 1.3 |
| Winter | 4.2 | 3.9 | 1.7 |
| | 6.0 | 2.8 | 1.2 |

[1]When less than 4 samples are collected per month, the TSD recommends using 4 as a default value for n.

# APPENDIX C

## Criteria and Limitation Calculations for Lead

Like most of the metals, the criteria for lead are hardness-dependent. Typically, the hardness at the edge of the mixing zone is used to determine the appropriate criterion. When there is no mixing zone available, the effluent hardness is used to calculate the criterion. Table C-1 presents the criteria for lead. The criteria consist of two parts - a criterion, which is based on total recoverable metal, and a conversion factor. The total recoverable criterion is multiplied by the conversion factor to obtain the dissolved criterion.

**Table C-1: Lead Criteria**

| | Conversion Factor | Criterion, Fg/l |
|---|---|---|
| Acute | (1.46203-0.145712*ln[hardness]) | exp(1.273*ln[hardness] -1.460) |
| Chronic | (1.46203-0.145712*ln[hardness]) | exp(1.273*ln[hardness] - 4.705) |

If these criteria are graphed with the hardness on the x axis and the criterion on the y axis, they form a convex (upward-bending) curve. However, as the effluent mixes with the receiving water, the hardness and the concentration of lead decrease along a straight line. Therefore, there will be instances when the concentration of metal in the receiving water/effluent mixture exceeds the criterion, as shown for the chronic criterion in Table C-2.

**Table C-2: Lead Concentrations vs. Chronic Criteria**

| Fraction Effluent | Mixed Hardness, mg/l $CaCO_3$ | Chronic Criterion, Fg/l | Lead Concentration, Fg/l |
|---|---|---|---|
| 1 | 132 | 3.40 | 3.40 |
| 0.8 | 110 | 2.78 | 2.80 |
| 0.6 | 87 | 2.17 | 2.20 |
| 0.4 | 65 | 1.56 | 1.61 |
| 0.2 | 42 | 0.978 | 1.02 |
| 0 | 20 | 0.420 | 0.420 |

To address this problem, EPA calculated “substitute criteria” (i.e., allowable 4-day and 1-hour concentrations, as appropriate) as tangents to the criteria curves at the receiving water hardness, as shown for the chronic lead criterion in Figure C-1. The tangent is a straight line that touches the criterion curve at the receiving water hardness and is

always below the curve. In addition, to ensure that the use of the conversion factor as a translator does not cause the receiving water concentrations to exceed the criteria, EPA calculated the criteria as total recoverable criteria, without the use of the conversion factor.

Because the criteria are applied at the point of discharge, the chronic criterion is more stringent, and is therefore the one used by EPA to establish effluent limitations. Using total recoverable lead criteria, the equation for the chronic criterion (CCC) becomes:

$$CCC = \exp(1.273*\ln[hardness] - 4.705) \quad (1)$$

The tangent to the curve is calculated by taking the first derivative of this equation and using that as the slope, m, in the equation for a straight line:

$$CCC = m*hardness+b \quad (2)$$

where

b = the y-intercept of the equation (the CCC that corresponds mathematically to hardness = 0)

The first derivative of the criterion is:

$$m = \frac{1.273*\exp(1.273*\ln[hardness]-4.705)}{hardness} \quad (3)$$

Evaluating this equation at a hardness of 20 mg/l results in the slope:

$$m = 0.026$$

Using the criterion corresponding to a hardness of 20 mg/l from Table C-2 and the slope from equation (3), solve equation (2) for the y-intercept:

$$b = 0.420 - 0.026*20$$
$$b = -0.1$$

The equation for the CCC then becomes:

$$CCC = 0.026*hardness - 0.1 \quad (4)$$

At a hardness of 132 mg/l:

$$CCC = 0.026*132-0.1$$
$$\mathbf{CCC = 3.3\ Fg/l}$$

Using this criterion, the reasonable potential analysis and permit limit development are performed as discussed in Appendix B, steps 2 and 3.